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TOMATO CULTIVAR EVALUATION

FOR PROCESSING

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OBJECTIVES

To evaluate new tomato cultivars that have already demonstrated positive attributes from a production standpoint to see if they also could produce a quality processed product. The cultivars are evaluated prior to, during and after processing for the major quality attributes.

PROJECT FUNDING

Mid-America Food Processors Association, Worthington, OH.

BACKGROUND

New processing tomato cultivars that are under development by OARDC plant breeders have been evaluated for processing quality attributes for over 40 years in an ongoing project in the OSU Food Industries Center pilot plant. If new cultivars demonstrate desirable production characteristics, they are placed in the processing trials for from one to several years to see if they produce desirable processing traits.

Initially, the tomatoes were canned as whole tomatoes and tomato juice. Some thirteen or fourteen years ago, diced tomatoes were added to the program. In addition, over the years tomatoes from these trials have been utilized as the raw product for many other processing studies. In recent years, all of these tomatoes have come from the Fremont, Ohio, OARDC vegetable research farm.

PROCEDURES UTILIZED

All tomatoes were grown and mechanically harvested at the OSU Department of Horticulture and Crop Science Research Farm at Fremont, Ohio. The fruit were harvested into steel dumping bins and trucked to the Food Industries Center Pilot Plant located in Howlett Hall on the OSU campus in Columbus, Ohio. The tomatoes were generally harvested one afternoon and trucked to Columbus early the next morning for processing that day.

The following is a flow chart for our Pilot Plant tomato operation:

1) All tomatoes were washed in a soak tank with air agitation.
2) Tomatoes were spray washed with 150 psi water while being conveyed on a roller conveyor.
3) Tomatoes were sorted to remove off quality fruit.
4) Tomatoes for juice were chopped in a Fitzpatrick Mill equipped with a 3/4" screen.
5) Tomatoes were pumped through a tube-in-tube heat exchanger to reach a hot break temperature of 190°F.
6) Tomatoes were extracted in a Chisholm-Ryder Company Model CJE-360-D28 screw type extractor with a .020 screen.
7) Tomatoes for whole or diced product after the spray washer were run through a Fox lye peeler with a peeling solution of approximately 18% lye at 190°F.

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8) Tomatoes were conveyed on a LaPort mat belt to provide approximately a 30-second lye reaction time.
9) Tomatoes were run over a Fox disk peeler for skin removal.
10) Tomatoes were sorted and hand-trimmed and peeled.
11) Tomatoes for dicing were run through an Urschel Laboratories, Inc. Model GK dicer set for ½" cubes.
12) All juice, whole tomatoes and diced were filled into a 300 x 406 cans, a Morton salt and acid tablet added, closed and processed at 220°F for 30 minutes.

Analytical procedures were conducted on the tomatoes prior to processing, during the processing operation after the hot break, and after the tomatoes had been processed and stored for at least 30 days. The test procedures included the following:

1) The pH was determined using a Corning Model 445 pH meter; total acid was determined by titrating to a pH of 8.1 with 0.1n sodium hydroxide.

2) Soluble solids were measured on an American Optic Abbey Refractometer.

3) Color was measured on the Agtron ME-5M and the Agtron M35-D colorimeters.

RESULTS

The data collected on this cultivar study are presented in **Tables I through III**. Table I lists the data on the raw product as it was received at the Food Industries Center Pilot Plant. Tests were conducted on juice extracted under vacuum from an 8-pound sample of raw tomatoes without any further processing. Table II lists the data obtained from juice immediately after the hot break and juice extraction unit operations. The date in **Table III** was gathered from tomato juice processed and stored over thirty days in room-temperature storage.

Each year, we state that environmental conditions for the past processing season deviated from those of the norm. I guess the real factor is that there is really a lack of a normal tomato season. This year, Ohio experienced a wide variation of environmental condition during the tomato planting and growing condition. Conditions at our Fremont farm were a little cool and wet, initially delaying the planting a few days, and then remained on the cool side throughout the summer. Our processing at the Food Industries Center did not begin until September 10 this year, as compared to September 4 last year, with both of these dates being later than usual. We did not finish our tomato cultivar evaluation until September 25, almost a week later than last year, with both of these dates being later than usual.

During the season, as we're doing our processing and evaluation work, we just naturally develop some perceptions about the year's crop without any actual data comparison. This year, I felt that the tomatoes were small, pH's were up, soluble solids were down, and color was good. My personal perceptions in this area were only partially correct, as for example, our average size of 58 tomatoes per 8# sample was almost ten tomatoes less, at 58 tomatoes per 8# sample than we experienced in 1996. This size difference is supported by the fact that in 1997, we only had one variety, OX 151, that had more than 70 tomatoes per 8#, as compared to 1996, where 15 cultivars had more than 70 tomatoes per 8# sample. pH was up this year from an average standpoint, with an average pH at 4.38, as compared to last year's average of 4.14. Of course, it's dangerous when comparing averages of so many cultivars,

but concern does sneak in as we continually see pH's rise into the danger zone of over 4.6 on raw product. The addition of combined salt and acid tablets takes care of the problem from a processing standpoint, but we must remember that there is a potential for a problem if a can is missed with a salt and acid tablet. The average solids this year was almost identical to last year, being at the 3.12 level on raw product and substantially higher on processed juice. Color, as determined by the Agtron ME-5M were very similar for the last two years.

A general observation concerning peeling was that the tomatoes peeled much easier this year overall than in the past. Our peeling procedures have been the same for a number of years, but our mechanical peel remover and final hand peeling were much easier and better than in years past.

RECOMMENDATIONS

This type of tomato cultivar evaluation should continue, as it provides valuable data for the tomato processing industry in Ohio and the Midwest. This information has been and will continue to be valuable to the industry as one criteria on which to select new cultivars for future operations.

1997 PROCESSING TOMATO CULTIVAR TRIALS

TABLE III — CANNED JUICE

LOT #	CULTIVAR	pH	% ACIDITY	SOLUBLE SOLIDS	AGTRON	AGTRON M35-D RED	AGTRON M35-D BLUE	AGTRON M35-D GREEN	AGTRON M35-D YELLOW
633	OX 178 R	4.25	.429	4.7	33	34.1	-0.2	4.0	5.7
634	RCAT 961	4.22	.371	4.1	40	32.4	-0.3	4.5	6.3
635	CC 390	4.18	.410	4.8	41	35.0	0.1	4.8	6.7
636	OX 193 R	4.13	.474	3.8	37	34.7	0.3	4.7	6.4
637	OX 101	4.10	.439	4.5	37	35.3	0.4	4.8	6.6
638	OX 27	4.16	.435	4.2	35	34.8	0.3	4.4	6.1
639	OX 150	4.19	.403	4.2	35	34.5	0.3	4.4	6.1
640	OX 197 R	4.17	.461	4.5	40	34.1	0.0	4.3	5.9
641	E 3211	4.15	.467	4.4	34	33.2	-0.1	3.9	5.4
642	OX 38	4.19	.435	4.3	37	34.6	-0.2	4.3	6.1
643	RCAT 956	4.15	.442	4.3	38	34.8	0.1	4.8	6.7
644	OX 26	3.94	.563	5.3	39	33.9	0.0	4.7	6.4
645	O 8245	4.12	.486	4.3	34	35.6	0.0	4.4	6.3
646	OX 173 R	4.16	.435	4.2	36	34.8	-0.1	4.2	6.0
647	OX 151	4.25	.397	3.7	36	34.6	0.1	4.5	6.2
648	O 9442	4.17	.493	4.0	35	35.1	0.3	4.6	6.4
649	OX 52	4.17	.416	3.7	36	34.2	0.1	4.5	6.0
650	OX 24	4.15	.442	3.8	32	33.6	-0.1	3.7	5.2
651	PS 696	4.17	.435	4.3	38	33.8	-0.2	4.5	6.2
652	OX 200 R	4.19	.416	3.7	37	34.6	0.3	4.6	6.3
653	O 9436	4.13	.467	4.0	33	33.4	-0.2	4.0	5.5
654	OX 228 R	4.19	.410	4.1	33	33.6	0.2	4.2	5.7
655	OX 42	4.29	.416	3.9	36	34.9	-0.1	4.3	5.9
656	HRC 91219	4.27	.352	4.0	32	33.9	-0.3	3.8	5.4
657	OX 72	4.18	.365	3.4	35	34.8	0.3	4.4	6.1
658	H 9423	4.12	.442	4.3	34	34.3	0.0	4.0	5.6
659	RCAT 951	4.12	.448	3.7	38	34.7	-0.2	4.6	6.3
660	OX 25	4.17	.461	3.8	38	34.4	-0.1	4.5	6.2
661	OX 195 R	4.20	.435	3.9	36	33.9	0.2	4.4	5.9
662	OX 23	4.14	.461	4.2	36	34.2	-0.2	4.3	5.9
663	OX 88	4.17	.416	4.0	34	33.9	0.2	4.4	5.9
664	O 7983	4.14	.493	4.6	35	33.4	0.2	4.5	6.2

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1997 PROCESSING TOMATO CULTIVAR TRIALS

TABLE II — IN PROCESS JUICE

LOT #	CULTIVAR	HARVEST DATE	pH	% ACIDITY	SOLUBLE SOLIDS	ME-5M AGTRON	AGTRON M35-D			
							RED	BLUE	GREEN	YELLOW
633	OX 178 R	9/24/97	4.53	.307	4.0	30	36.1	.2	3.7	5.6
634	RCAT 961	9/24/97	4.61	.262	3.3	34	34.7	.1	4.2	6.4
635	CC 390	9/24/97	4.50	.301	4.1	35	36.3	.7	4.3	6.5
636	OX 193 R	9/15/97	4.33	.320	3.0	35	37.0	.6	4.2	6.3
637	OX 101	9/09/97	3.95	.416	3.6	31	37	.5	4.3	6.5
638	OX 27	9/15/97	4.36	.339	3.0	32	36.8	.5	3.9	5.9
639	OX 150	9/15/97	4.29	.371	3.4	30	37.1	.5	4.0	6.0
640	OX 197 R	9/17/97	4.39	.333	3.5	33	36.2	.5	4.0	6.0
641	E 3211	9/22/97	4.41	.346	3.9	30	35.1	.4	3.7	5.4
642	OX 38	9/24/97	4.50	.262	3.5	34	37.1	.4	4.1	6.2
643	RCAT 956	9/24/97	4.39	.379	3.8	32	34.5	.6	4.2	6.6
644	OX 26	9/24/97	4.40	.332	3.6	35	35.7	.4	4.1	6.5
645	O 8245	9/22/97	4.34	.422	3.3	34	37.5	.6	4.2	6.4
646	OX 173 R	9/22/97	4.39	.313	3.1	31	37.2	.4	4.0	6.1
647	OX 151	9/15/97	4.40	.301	2.8	29	34.2	.4	3.9	6.1
648	O 9442	9/15/97	4.33	.358	3.3	31	37.4	.6	4.2	6.5
649	OX 52	9/15/97	4.40	.288	2.9	33	36.5	.5	4.0	6.0
650	OX 24	9/17/97	4.40	.326	3.2	28.5	35.	.4	3.5	5.1
651	PS 696	9/22/97	4.40	.320	3.1	32	37.4	.4	4.3	6.5
652	OX 200 R	9/09/97	4.00	.365	3.1	37	36.6	.6	4.2	6.4
653	O 9436	9/17/97	4.38	.339	3.0	29	35.6	.3	3.7	5.5
654	OX 228 R	9/17/97	4.44	.320	3.2	31	35.1	.5	3.7	5.5
655	OX 42	9/17/97	4.43	.275	3.0	32	36.7	.5	4.0	6.0
656	HRC 91219	9/24/97	4.62	.236	3.3	29	36.1	.2	3.7	5.5
657	OX 72	9/15/95	4.42	.256	2.6	31	37.0	.6	4.0	6.1
658	H 9423	9/22/97	4.33	.384	3.4	29	37.0	.5	3.7	6.5
659	RCAT 951	9/22/97	4.38	.352	3.2	33	38.0	.3	4.2	6.1
660	OX 25	9/22/97	4.36	.339	3.5	34	37.7	.3	4.2	6.3
661	OX 195 R	9/17/97	4.46	.307	3.1	32	36.2	.7	3.8	5.7
662	OX 23	9/17/97	4.34	.346	3.1	31	36.9	.3	4.0	6.0
663	OX 88	9/09/97	4.00	.390	3.3	35	35.7	.4	3.9	5.8
664	O 7983	9/09/97	3.95	.454	3.9	37	34.9	.5	4.0	6.1

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1997 PROCESSING TOMATO CULTIVAR TRIALS

TABLE I — RAW PRODUCT

LOT #	CULTIVAR	COUNT/ 8 LBS.	pH	% ACIDITY	SOLUBLE SOLIDS	ME-5M AGTRON	AGTRON RED	AGTRON BLUE	M 35-D GREEN	M 35-D YELLOW
633	OX 178 R	55	4.61	.243	3.7	55	49.2	2.2	6.5	11.3
634	RCAT 961	64	4.58	.205	3.1	49	46.6	1.2	5.8	10.2
635	CC 390	51	4.59	.243	3.8	56	49.9	2.3	6.4	11.1
636	OX 193 R	49	4.32	.301	2.8	35	40.7	1.1	4.7	7.9
637	OX 101	62	3.85	.365	3.3	44	41.3	1.9	5.6	9.0
638	OX 27	58	4.43	.275	3.0	35	41.6	1.4	5.0	8.4
639	OX 150	61	4.46	.243	2.9	36	39.8	1.0	4.5	7.5
640	OX 197 R	50	4.44	.262	3.2	54	45.4	2.0	5.7	9.7
641	E211	51	4.42	.288	3.8	47	47.4	2.1	5.9	10.0
642	OX 38	59	4.50	.314	3.3	44	49.4	1.8	6.0	10.5
643	RCAT 956	57	4.53	.301	3.4	45	45.3	1.3	6.1	10.5
644	OX 26	57	4.46	.243	3.3	46	46.6	1.5	5.8	10.1
645	O 8245	60	4.43	.288	3.1	49	47.8	2.0	6.0	10.6
646	OX 173 R	58	4.46	.250	3.1	50	47.2	1.8	6.1	10.7
647	OX 151	74	4.44	.288	2.7	40.5	41.0	1.0	4.7	8.0
648	O 9442	68	4.33	.326	2.9	39	41.6	1.4	5.1	8.6
649	OX 52	67	4.40	.294	2.7	33	38.5	1.0	4.5	7.5
650	OX 24	52	4.39	.282	3.1	40	42.8	2.0	5.9	9.5
651	PS 696	51	4.39	.288	3.1	52	49.0	2.0	6.7	11.5
652	OX 200 R	62	4.00	.352	2.9	49	44.3	1.8	5.9	10.1
653	O 9436	53	4.40	.294	3.3	35	39.6	1.8	5.0	7.8
654	OX 228R	56	4.43	.288	3.0	39	39.0	1.8	5.3	8.4
655	OX 42	62	4.44	.256	3.3	37	43.2	2.0	6.0	9.7
656	HRC 91219	55	4.63	.205	2.9	34	44.0	.9	4.5	8.0
657	OX 72	65	4.38	.218	2.3	31	40.2	1.0	4.6	7.8
658	H 9423	55	4.38	.294	3.4	44	47.3	1.7	5.4	9.4
659	RCAT 951	51	4.50	.256	3.2	47	46.2	1.5	6.2	10.6
660	OX 25	56	4.47	.282	3.0	53	46.7	1.6	1.0	10.6
661	OX 195 R	49	4.42	.262	2.8	40	43.4	2.0	5.8	9.5
662	OX 23	61	4.39	.294	2.9	55	45.6	1.6	5.7	9.8
663	OX 88	65	4.00	.339	3.0	50	42.8	1.5	5.0	8.1
664	O 7983	61	4.05	.390	3.6	4.5	32.2	1.5	5.0	8.6

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